USAARL Report No. 93-17



# Automaticity of Processing Location versus Identity Information in Brief Visual Displays

by

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Biomedical Applications Research Division



March 1993



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SECURITY CLASSIFICATION OF THIS PAGE

# REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

**1a. REPORT SECURITY CLASSIFICATION:** Unclassified

**1b. RESTRICTIVE MARKINGS:**

**2a. SECURITY CLASSIFICATION AUTHORITY:**

**2b. DECLASSIFICATION / DOWNGRADING SCHEDULE:**

**3. DISTRIBUTION / AVAILABILITY OF REPORT:** Approved for public release; distribution unlimited

**4. PERFORMING ORGANIZATION REPORT NUMBER(S):** USAARL Report No. 93-17

**5. MONITORING ORGANIZATION REPORT NUMBER(S):**

**6a. NAME OF PERFORMING ORGANIZATION:** U.S. Army Aeromedical Research Laboratory

**6b. OFFICE SYMBOL (If applicable):** SGRD-UAB-CS

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**8b. OFFICE SYMBOL (If applicable):**

**9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER:**

**8c. ADDRESS (City, State, and ZIP Code):**

**10. SOURCE OF FUNDING NUMBERS**

| PROGRAM ELEMENT NO. | PROJECT NO. 3M2630 | TASK NO. | WORK UNIT ACCESSION NO. |
|---|---|---|---|
| 0603002A | 02D995 | OD | 102 |

**11. TITLE (Include Security Classification):** (U) Automaticity of Processing Location versus Identity Information in Brief Visual Displays

**12. PERSONAL AUTHOR(S):** Robert L. Stephens and Jacquelyn Y. Pearson

**13a. TYPE OF REPORT:** Final

**13b. TIME COVERED:** FROM ________ TO ______

**14. DATE OF REPORT (Year, Month, Day):** 1993 March

**15. PAGE COUNT:** 14

**16. SUPPLEMENTARY NOTATION:**

**17. COSATI CODES**

| FIELD | GROUP | SUB-GROUP |
|---|---|---|
| 05 | 08 | |
| | | |

**18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number):** Visual information processing, tachistoscopic presentations, automaticity

**19. ABSTRACT (Continue on reverse if necessary and identify by block number)**

Differential levels of automaticity for processing information from tachistoscopic displays were studied using three variations of the partial report procedure (Averbach and Coriell, 1961). Processing of both spatial and identity information in letter displays was assessed simultaneously and then independently. Analyses indicated feature extraction is a highly automated process while spatial information extraction is a controlled process. Implications for separate processing pathways in the visual system are discussed.

**20. DISTRIBUTION / AVAILABILITY OF ABSTRACT:** ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS

**21. ABSTRACT SECURITY CLASSIFICATION:** Unclassified

**22a. NAME OF RESPONSIBLE INDIVIDUAL:** C, Scientific Information Center

**22b. TELEPHONE (Include Area Code):** (205) 255-6907

**22c. OFFICE SYMBOL:** SGRD-UAX-SI

DD Form 1473, JUN 86 — Previous editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

Unclassified

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## Acknowledgments

We would like to thank COL J. D. LaMothe for many valuable discussions during the planning and development of this research project. Also, we would like to thank the many people who assisted in the design of the study, the recruitment of subjects, and the collection and analysis of the data for this study: Dr. John Caldwell, Dr. Carlos Comperatore, Mr. Jim Chiaramonte, 2LT Paul Eno, Ms. Gloria Kennedy, SGT Angelia Mattingly, SSG Lonnie Mills, 2LT Jim Neugent, SP4 Vadankumar Patel, SSG Norman Pearson, PFC Hilda Pou, 2LT Shawn Prickett, PFC Michael Sisson, and Mr. Lew Stone.

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## Introduction

Shiffrin and Schneider (1977) advanced the notion that human information processing involves two distinct, but interrelated, modes: automatic and controlled processing. They defined automatic processes as being unaffected by practice, placing little demand on attention, being difficult to suppress once learned, and being virtually unaffected by processing load. Controlled processes, on the other hand, exhibit practice effects, place a large demand on attention, are relatively easy to alter, and are very dependent on processing load.

Hasher and Zacks (1979) incorporated this distinction into a set of criteria which must be satisfied before declaring that an attribute of the stimulus is automatically encoded. For a process to be automatic, it should be unaffected by intention, age, simultaneous processing demands, practice, or individual differences. They suggested that spatial location information processing is automatic.

Sagi and Julesz (1985) reported psychophysical evidence suggesting that localization appears to be automatic while identification appears to be a controlled process. Their subjects could detect and locate feature gradients in a complex stimulus in parallel. However, in order to identify the orientation of the features, they had to perform a serial inspection of the stimulus with focal attention.

Other research suggests the opposite. Butler (1980) found attention instructions differentially affected the occurrence of intrusion errors and mislocation errors in a selective masking task. Intrusion errors appeared to reflect an identification process which is relatively insensitive to attention instructions, suggesting identification is an automatic process. Mislocation errors appeared to reflect a localization process which is affected by attention instructions, suggesting localization is the principal limited-capacity operation.

Mason (1980) examined differences in highly skilled and less skilled readers' performances in a tachistoscopic task. She suggested location and identity information are processed independently. Highly skilled readers and less skilled readers were equally proficient at identifying letters which were presented in the central field-of-view. However, when the task was to name the serial position of a letter among nontarget items (an uppercase X superimposed on a dollar sign) highly skilled readers were significantly better than less skilled readers. Furthermore, when position of the target letter among the nontarget items was known, there was no difference in performance for the two groups. But when the target letter had to be located first, the highly skilled readers again were significantly better than the less skilled readers. Thus, her results suggest that location information processing is a controlled process while identity information processing is automatic.

Naveh-Benjamin (1988) also failed to support the automaticity of spatial location information processing using a picture recognition task. In addition, Stephens and Runcie (1990) found individual differences in the ability to process location and identity information in a series of tachistoscopic tasks.

These inconsistencies in the determination of the level of automaticity of location and identity information processing appear to result from the definition of location and identity information within the various paradigms employed. The purpose of this investigation was to determine the differential levels of automaticity for processing location and identity information from tachistoscopically presented letter displays.

We hypothesized that acquisition of spatial location information in a tachistoscopically presented task would reflect controlled processing while acquisition of identity information would reflect automatic processing. To test this hypothesis, we used three variations of the partial report procedure (Averbach and Coriell, 1961) to examine: 1) the effects of processing location and identity information simultaneously and then independently on the accuracy of performance, and 2) the effects of practice on the ability to extract location and identity information.

## Method

### Subjects

Twelve male Army aviators were tested once a day for 4 days as training in preparation for a study of the effects of antihistamines on performance. Their ages ranged from 23 to 46 years (mean=32.42, s.d.=7.32). Six subjects performed the tasks at 1300 hours on each of 4 test days. The remaining six performed the tasks at 1500 hours. Subject participation was voluntary, and all subjects signed volunteer consent agreements.

## Materials

Each test session involved the administration of three visual information processing tasks: a) a bar probe task, b) a letter identity task, and c) a letter location task. A Gerbrands 3-field tachistoscope (model 1483)* was used for stimulus presentation. The entire stimulus plane was 12.83° wide. Letter arrays consisted of eight randomly selected consonants (excluding Y). All letter stimuli were Helvetica 24 point black pressure-sensitive transfer letters on a white background. Bar probes were constructed using the letter I. Each array had an angular subtense of 5.53° horizontally and 0.41° vertically. Bar and letter probes were presented 0.30° above the letter array.

## Procedure

Each task began with the presentation of 10 practice trials. Following practice, 64 test trials were presented. There were two trials at each array position for each of four interstimulus intervals. Each trial was preceded by a 500 ms presentation of a fixation cross located in the center of the stimulus field.

In the bar probe task, the fixation cross was followed by an array of 8 letters presented to the subject for 50 ms. Then a variable, dark interstimulus interval (ISI) of either 0-, 150-, 300-, or 450-ms duration was presented. Following the ISI, a bar probe appeared above one of the 8 positions of the array for 50 ms. The subject's task was to report correctly the letter which had appeared in the probed position. If he was unsure of the response, he was asked to guess. This task required the subject to extract letter location and identity information concurrently.

The letter identity task involved an array presentation identical to the bar probe task. Again, the array was followed by a variable, dark ISI. Following the ISI in this task, the subject was presented with a letter probe which appeared above the middle of the array. The subject's task was to decide whether or not the probe letter had appeared anywhere in the array. Presence or absence of the probe letter was random with the restriction that it was present on half of the trials and absent on the other half. In this task, the need to retain location information was minimized.

The letter location task was physically identical to the letter identity task. The subject was presented with the array,

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* See appendix A

the variable dark ISI, and the letter probe above the middle of the array. In this task, however, the letter probe always was present in the array and the subject's task was to report the number of the position (1-8) the probe letter had occupied in the array. This task required subjects to extract spatial location information about the letters relative to the letter display while minimizing the need to retain identity information.

## Results

A 4 x 3 x 4 repeated measures analysis of variance was performed with day, task, and ISI as factors. Reported $p$-values reflect corrections applied to the degrees of freedom where the sphericity assumption was violated. Results of this analysis revealed significant two-way interactions between day and ISI, $F(5.03, 55.31) = 2.55$, $p < 0.05$, and between day and task, $F(5.85, 64.40) = 2.37$, $p < 0.05$. In addition, the task x ISI interaction was marginally significant, $F(2.79, 30.66) = 2.55$, $p < 0.10$. Number of correct responses as a function of day and ISI for the three tasks is depicted in Figures 1-3.

Simple effects analysis for the day x task interaction revealed day simple effects on the bar probe task ($p < 0.0005$) and on the letter location task ($p < 0.005$). Contrasts for the day effect on the bar probe task indicated an increase in scores from day 1 to days 3 and 4. In addition, performance on day 4 was better than performance on day 2. Contrasts for the day effect on the letter location task indicated scores increased on days 3 and 4 compared to days 1 and 2.

Also, there were task simple effects for day 1 ($p < 0.0001$), day 2 ($p < 0.0001$), day 3 ($p < 0.0005$), and day 4 ($p < 0.05$). Contrasts for the task simple effects indicated letter identity task scores were higher than either bar probe or letter location task scores on each day.

The day x ISI interaction was accounted for by ISI simple effects on day 3 ($p < 0.05$) and day 4 ($p < 0.05$). Contrasts for the ISI simple effect on day 3 indicated a reduction in accuracy from 0 ms to 450 ms ISI, and from 300 ms to 450 ms ISI. Contrasts for the ISI simple effect on day 4 indicated lower performance at both 300 ms and 450 ms ISI compared to 150 ms ISI.

Further, there were day simple effects at 3 levels of ISI: 0 ms ($p < 0.0005$), 150 ms ($p < 0.005$), and 300 ms ($p < 0.001$). The contrasts for these effects revealed a significant increase in accuracy from day 1 to days 3 and 4 at 0 ms ISI. Accuracy increased significantly from day 1 to day 4 at 150 ms ISI, while

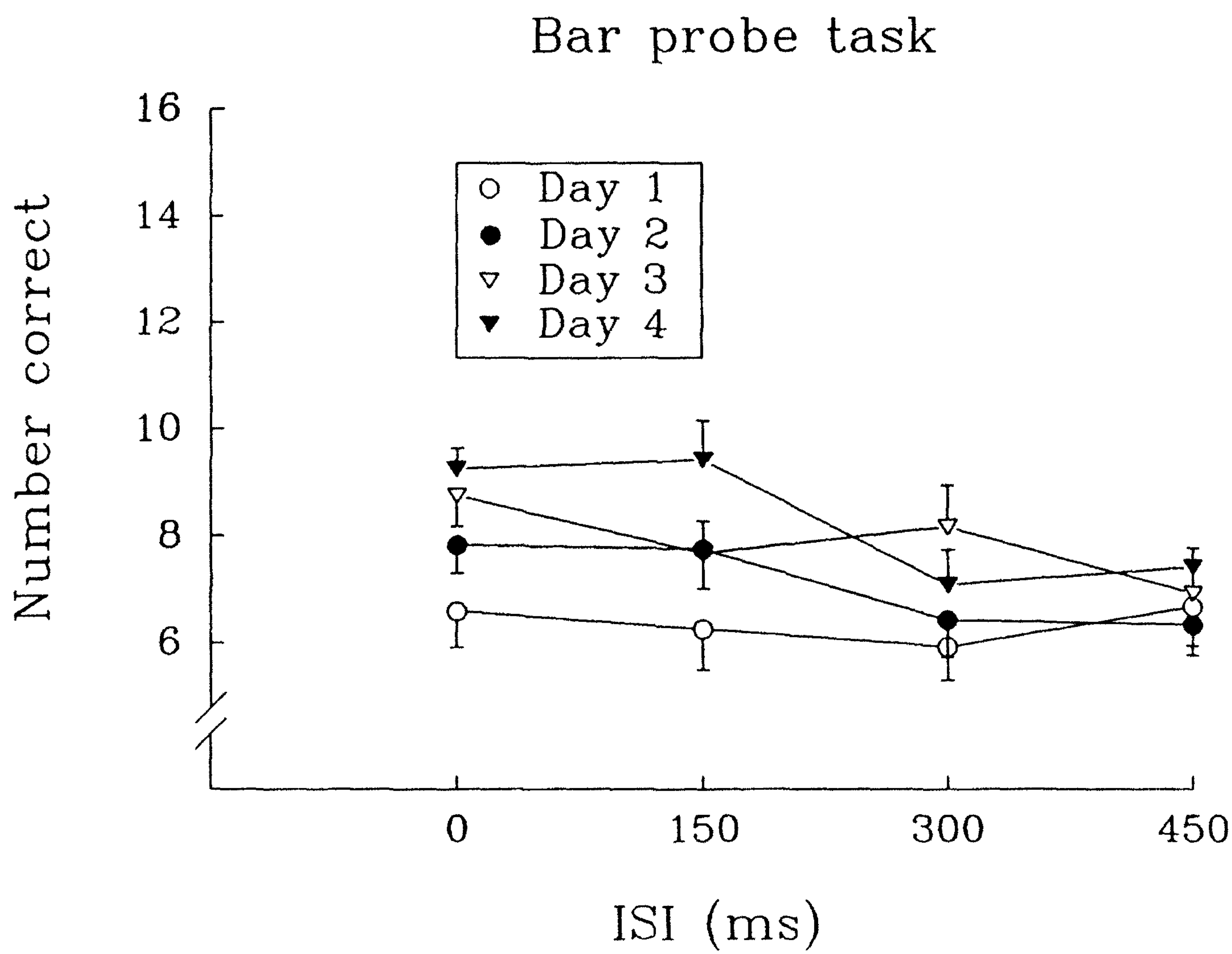


Figure 1. Number correct out of 16 as a function of day and interstimulus interval (ISI) for the bar probe task.

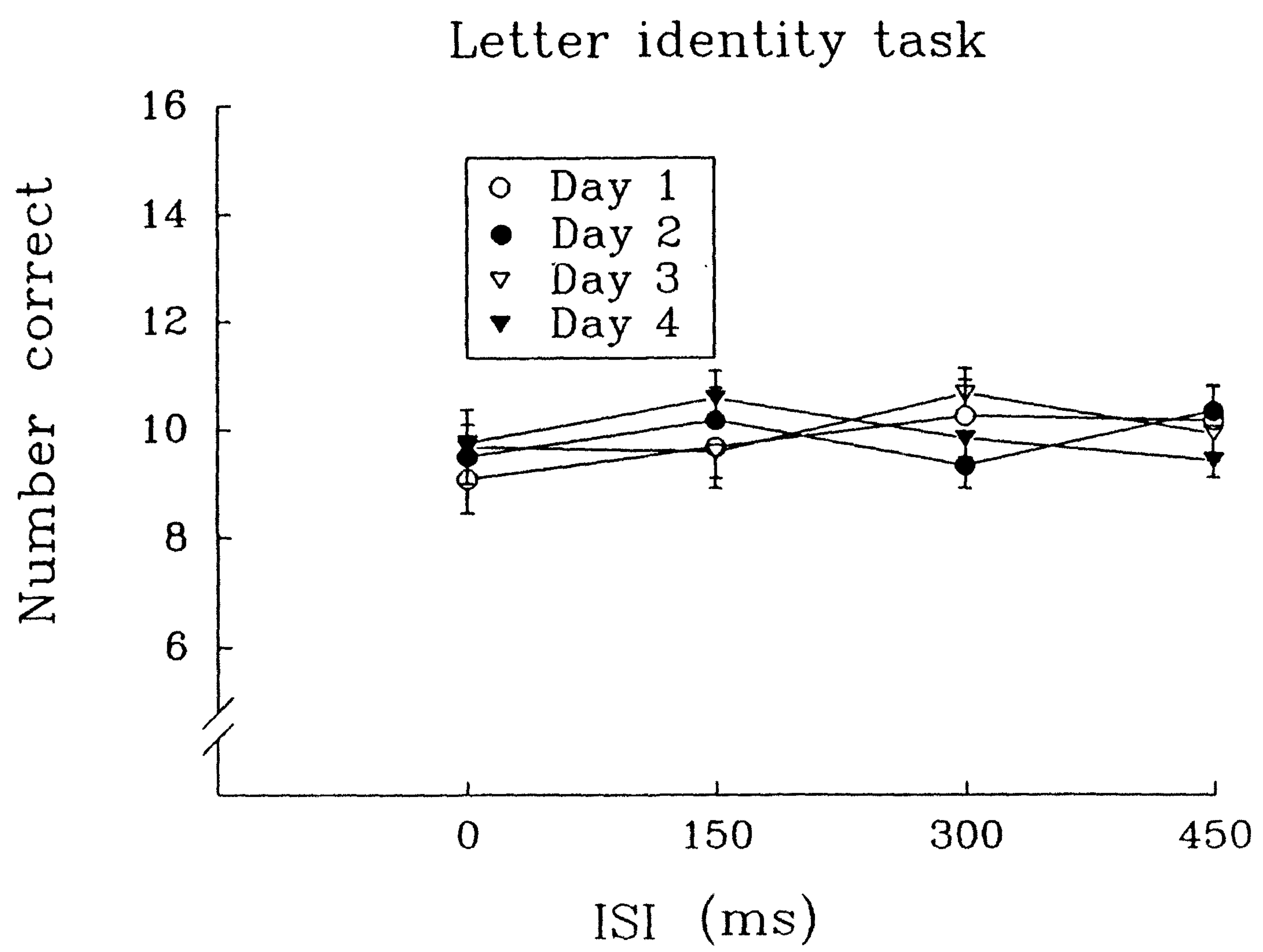


Figure 2. Number correct out of 16 as a function of day and interstimulus interval (ISI) for the letter identity task.

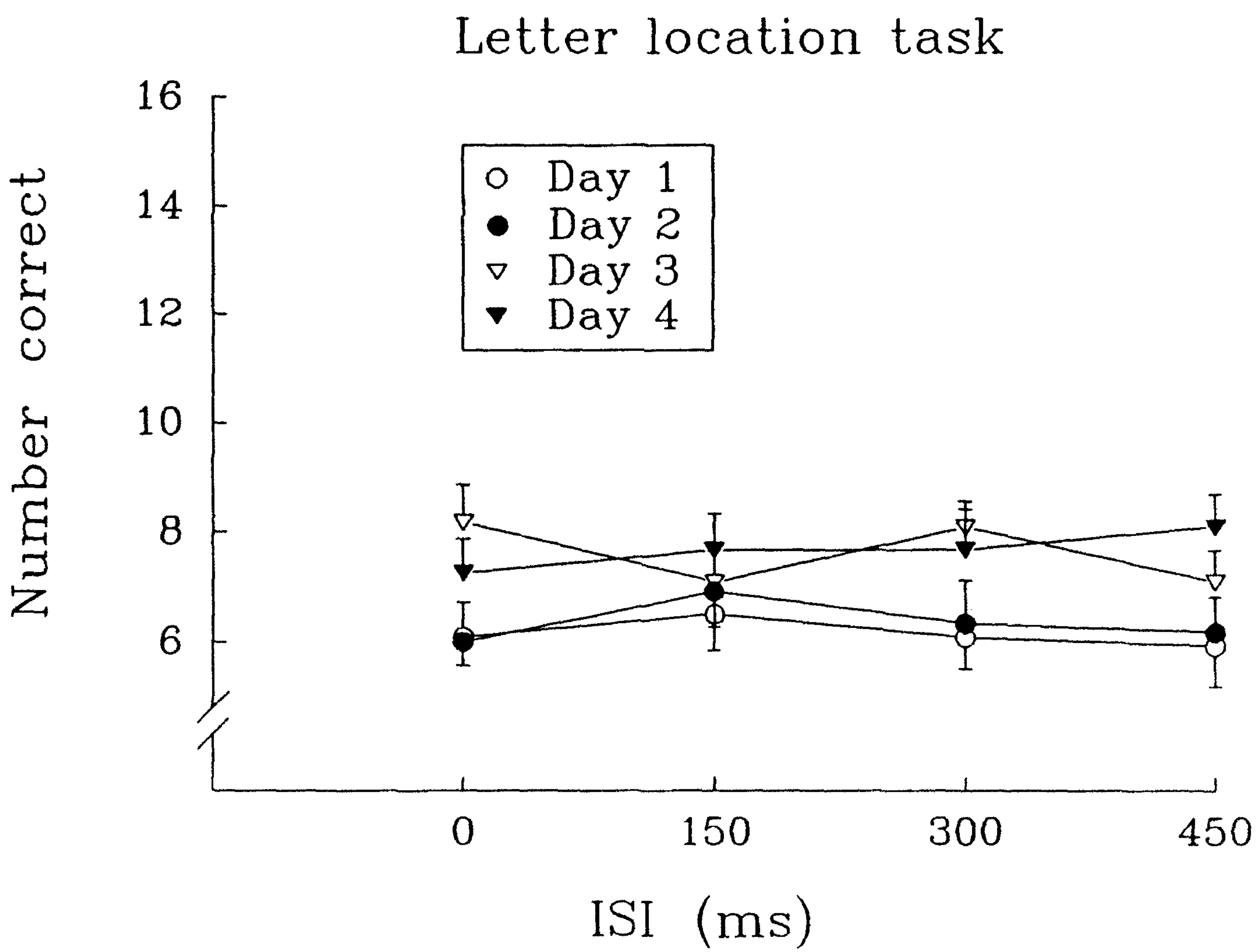


Figure 3. Number correct out of 16 as a function of day and interstimulus interval (ISI) for the letter location task.

only the increase from day 1 to day 3 was significant at 300 ms ISI.

## Discussion

For the tasks employed in this experiment, automaticity occurs when localization or identification of a stimulus does not require conscious direction of attention to memory representations of letter features or their spatial relationships. Automaticity fails when one must consciously direct attention to letter feature or location information (c.f., Hasher and Zacks, 1979; Shiffrin and Schneider, 1977).

Evidence for automaticity of letter identification is provided by the lack of practice effects on the letter identity task. This likely results from the extensive experience normal adults have with letter feature acquisition during reading (Fisher and Montanary, 1977). Letter location appears to be a controlled process, as evidenced by the increase in accuracy of performance with practice on the letter location task. While concomitant experience in letter location information processing is gained with reading experience, the use of random consonant arrays in this study removed any facilitation such experience would provide by eliminating phonologically recognizable consonant-vowel combinations. Thus, whole-word processing is replaced with a lower-level, letter-by-letter process.

Both the letter location task and the bar probe task showed improvement in performance with practice, but practiced performance in the letter location task showed no loss of location information with increasing ISI, whereas performance in the bar probe task did. If processing of letter location information is becoming increasingly automatic, as indicated by improvement with practice, then either the process of acquisition of letter location information in the two tasks is different, or the requirement to process both types of information simultaneously impairs performance at the longer ISIs.

While both tasks elicit controlled processes initially, the available location information is used differently. In the bar probe task, the subject appears to rely on the provision of a location cue which directs attention to the important feature information. No such location cues are provided in the letter location task which forces subjects into more complete processing of feature information from the entire display prior to cue presentation. Cue processing in the letter location task may require feature extraction to the level necessary for a physical match, thus allowing a longer time for decay of feature information from the memory representation of the array. This would account for the lower accuracy at the shorter ISIs in the letter location task relative to the bar probe task.

Phenomenologically, there seems to be a unitary quality to the perception of location and identity information in the visual system. However, the existence of differential levels of automaticity for identity and location information suggests that these two processes are independent. There is much evidence, both physiological and behavioral, to support this conclusion. Schneider (1969) reported evidence suggesting localization and pattern recognition in hamsters are mediated by different areas of the brain. DeYoe and Van Essen (1988) cited evidence for separate processing pathways in primate cortex, but argued that connections between parallel pathways could provide redundant representation of sensory cues in different anatomical areas. Behaviorally, many experiments with humans point to this same independence of identity and location information (Butler, 1980; Dick, 1969; Mason, 1980; Sagi and Julesz, 1985; and Townsend, 1973). This evidence, combined with the findings of the present investigation, suggests spatial and identity information must be processed by different areas of the visual system.

## References


Averbach, E., and Coriell, A. S. 1961. Short-term memory in vision. Bell System technical journal. 40: 309-328.

Butler, B. 1980. Selective attention and stimulus localization in visual perception. Canadian journal of psychology. 34: 119-133.

DeYoe, E. A., and Van Essen, D. C. 1988. Concurrent processing streams in monkey visual cortex. Trends in neurosciences. 11(5): 219-226.

Dick, A. O. 1969. Relations between the sensory register and short-term storage in tachistoscopic recognition. Journal of experimental psychology. 82: 279-284.

Fisher, D. F., and Montanary, W. E. 1977. Spatial and contextual factors in beginning reading: Evidence for PSG-CSG complements to developing automaticity? Memory and cognition. 5(2): 247-251.

Hasher, L., and Zacks, R. T. 1979. Automatic and effortful processes in memory. Journal of experimental psychology: General. 108(3): 356-388.

Mason, M. 1980. Reading ability and the encoding of item and location information. Journal of experimental psychology: Human perception and performance. 6: 89-98.

Naveh-Benjamin, M. 1988. Recognition memory of spatial location information: Another failure to support automaticity. Memory and cognition. 16(5): 437-445.

Sagi, D., and Julesz, B. 1985. "Where" and "what" in vision. Science. 228: 1217-1219.

Schneider, G. E. 1969. Two visual systems. Science. 163: 895-902.

Shiffrin, R. M., and Schneider, W. 1977. Controlled and automatic human information processing: II. Perceptual learning, automatic attending, and a general theory. Psychological review. 84(2): 127-190.

Stephens, R., and Runcie, D. 1990. Individual differences in spatial and identity information processing in iconic memory. Perceptual and motor skills. 71: 1293-1294.

Townsend, V. M. 1973. Loss of spatial and identity information following tachistoscopic exposure. Journal of experimental psychology. 98: 113-118.

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